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General surgical injuries in survivors of the M1 Kegworth air crash

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The general surgical consequences of the M1 Kegworth air crash are described. Considering the severe nature of the injuries sustained by the survivors, surprisingly few required general surgical intervention. Intra-abdominal injuries were rare despite the abdomen's apparent vulnerability to injury; only five laparotomies were performed. However, 30 (34%) of survivors demonstrated significant bruising from lap belts and 13 patients had haematuria. The majority of operations carried out were orthopaedic related.

On 8 January 1989, at 8.26 pm, a Boeing 737 bound from Heathrow to Belfast, crashed on to the M1 motorway while attempting an emergency landing at East Midlands Airport. On impact the aircraft broke into three main sections, the cockpit, fuselage, and tail. Of the 126 passengers and crew on board, 39 died at the scene of the accident, leaving 87 initial survivors, a large number for an air crash. The survivors were transferred to four different hospitals in the region (Fig. 1). Four patients died from their injuries soon after arrival at hospital.

Two papers (*1,2*) have commented that abdominal injuries were rare in this air crash. A review of the literature reveals only one published report that comments on intra-abdominal injuries in survivors of an air crash, and no mention is made of the extent of the pathology (*3*). This paper reviews the abdominal injuries sustained in the 87 passengers and crew who survived the impact, and examines the general surgical workload created by the air crash. For legal reasons we cannot comment on injuries sustained by those who died at the crash site.

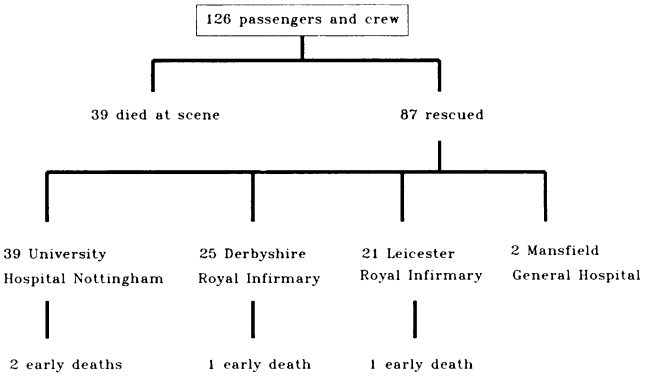

Figure 1. Distribution of survivors.

Patients and methods

All air crash survivors' records and X-rays were reviewed. Patients remaining in hospital were interviewed and bruising recorded, with particular attention to abdominal bruising related to seat belts. All patients were questioned on the posture they adopted at the time of the crash. Photographs were taken of any bruising

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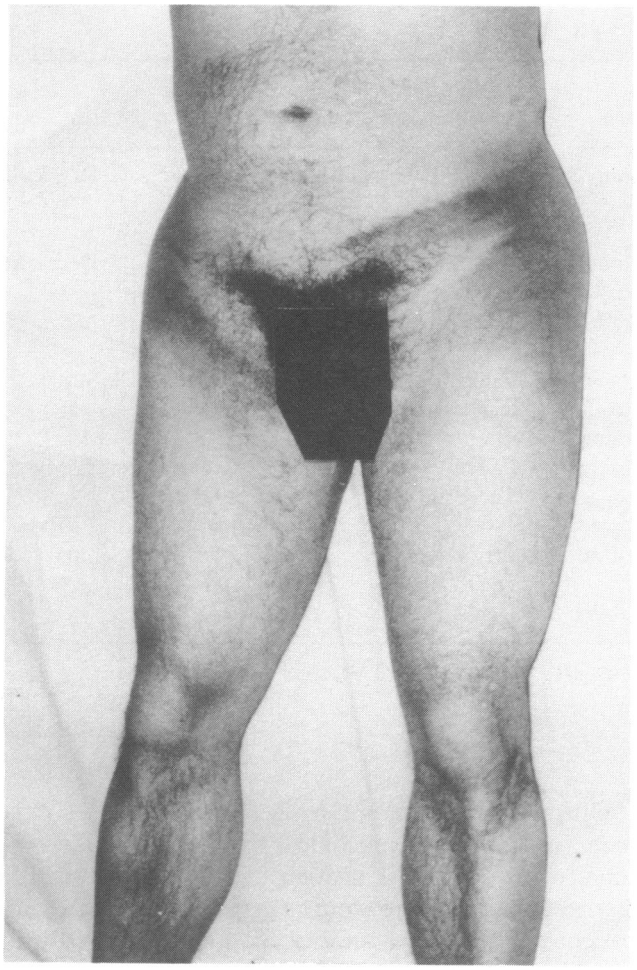
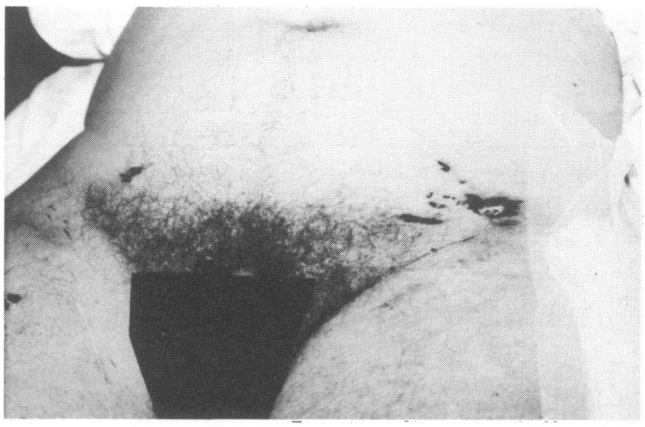


(*a*)

(*b*)



(*c*)

Figure 2. Examples of the 'seat belt sign' as seen in survivors of the M1 Kegworth air crash. (*a*) Bruising of the pelvis and lower abdomen. (*b*) Bruising and abrasions associated with lap belt. (*c*) Necrosis over the anterior superior iliac spine.

present on the 64 patients still in hospital 5 days after admission.

Results

All 87 survivors of the air crash sustained injuries ranging from simple bruising to severe multisystem injuries. Injury severity scores (ISS) (*4*) calculated for the survivors indicate that the average ISS was 16 (range 1–50). A definition of a 'multiply-traumatised patient' is any patient with an ISS of 16 or over (*5*).

Thirty patients (34%) demonstrated a pattern of significant bruising and abrasions across the pelvis and lower abdomen, associated with the wearing of a lap belt. Of these patients, four had necrosis over their anterior superior iliac spines (Fig. 2). At the time of impact, 11 patients had adopted a recognised brace (crash) posture, seven a semibraced posture (ie they achieved a posture midway between a fully braced posture and an unbraced upright posture), and four had remained seated upright.

Table I. Patients having laparotomies

Patient number	*Age*	*Sex*	*ISS*	*TOA-OP*	*Injuries*	*Operation*	*Indication for laparotomy*	*Findings*	*Outcome*
1	67	M	26	5 min	Multiple #s Head injury	Laparotomy	Falling BP	Nil significant Mild bleeding from porta hepatis	Deceased
2	61	M	27	25 min	Multiple #s Head injury Chest Spinal #	Laparotomy # fixation Chest drain	Falling BP Tenderness Bruising	Nil significant Mesenteric bruising	Deceased
3	52	F	45	30 min	Multiple #s Head injury Chest	Laparotomy # fixation Chest drains	Falling BP Rigid abdomen	Nil significant Liver haematoma	Survived
4	32	F	27	55 min	Multiple #s Chest	Splenectomy # fixation	Falling BP Tense abdomen	Ruptured spleen Perinepheric haematoma	Survived
5	23	M	19	95 min	Right limb # Diastasis of symphysis pubis	Repair ruptured bladder Wound toilet	Tenderness Positive lavage	Ruptured bladder Tear serosa sigmoid colon	Survived

Key: # = fracture. ISS = injury severity score. TOA-OP = time of arrival to operation

Table II. Number of operations per specialty on survivors of air crash

Surgical specialty	*No. of operations*	*% of total*
Orthopaedic	295	85.5
General	13	3.8
ENT	4	1.2
Neurosurgery	4	1.2
Ophthalmology	4	1.2
Thoracic	2	0.6
Faciomaxillary	2	0.6
Plastic	2	0.6
Others (*unknown)	19	5.5

These figures exclude suture of simple lacerations and wound inspections

* Operations carried out by unknown specialty

Eight patients could not recall the posture they adopted at the time of the crash because of head injuries.

Five laparotomies were performed on survivors of the air crash (Table I). Three revealed no significant intra-abdominal injury. One patient required a splenectomy for a splenic tear and another a repair of an intraperitoneal rupture of the bladder and a serosal tear of the sigmoid colon. All five patients requiring laparotomies were severely injured, with an average ISS of 29 (range 19–45).

In total, 345 operations were performed on the 87 survivors (Table II). Of these, 295 (85%) were orthopaedic procedures and only 13 (3.8%) general surgical procedures. All operations by general surgeons were performed soon after the patient arrived in hospital, with the longest delay between arrival and operation being 95 minutes.

Operations carried out by general surgeons on the night of the crash, included five laparotomies, one thoracotomy, bilateral ligation of the external carotid arteries plus a tracheostomy (performed on the same patient), and five peritoneal lavages. Of the five patients who had peritoneal lavage, the only positive lavage was in the patient (No. 5) with a ruptured bladder. The other four patients underwent peritoneal lavage for investigation of abdominal pain and hypotension of uncertain origin.

Thirteen patients had haematuria, 11 microscopic and two macroscopic. Haematuria was recorded in seven patients with significant seat belt bruising, one patient with a pelvic fracture, and one patient with a lumbar spinal fracture. Nine patients recalled that they had adopted a braced posture, two patients remained upright in their seats and two patients could not recall the posture they adopted. At 6 months no patient demonstrated any late sequelae of genitourinary tract damage.

No urgent contrast radiological investigations, CAT scans or ultrasound scans were requested for investigation of intra-abdominal injuries.

Six patients had mediastinal widening, although angiography failed to show any significant vascular lesion. Four of these patients had sustained cervical or thoracic spinal fractures.

Discussion

Considering the severe nature of the injuries sustained by the survivors of the air crash, suprisingly few required general surgical intervention. Intra-abdominal injuries were rare despite the apparent vulnerability of the abdomen to injury.

One previous collective review on intra-abdominal injuries in aircraft accidents *(3)*, indicates that the incidence of hepatosplenic injury is greater in fatally injured victims than survivors, that there is a lower incidence of abdominal injury than injury to other regions, and that abdominal injuries often occur in association with head, chest, and limb injuries. Indeed, in his review of 72 aircraft accidents, Hill *(3)* reported only two survivors with intra-abdominal injuries and these were of a mild degree. Our findings support these observations.

The 'seat belt sign' *(6,7)*, as described in victims of automobile accidents, was seen in a large number of the survivors. The appearance of bruising and abrasion associated with the wearing of a lap-type seat belt in automobile accidents has suggested that intra-abdominal injury should be expected *(6,8)*, and may be considered an indication for early laparotomy *(9,10)*. Our experience indicates that despite the high incidence of the 'seat belt sign', serious intra-abdominal injuries were few.

No clear relationship emerged between the posture adopted at the time of the crash and the presence of the 'seat belt sign', although haematuria was observed more commonly in those patients who adopted a recognised braced crash posture.

In automobile accidents the incorrect positioning of lap belts, such that they ride up over the anterior superior iliac spines, may account for an increased incidence of intra-abdominal injuries *(6,7,11)* and, in particular, rupture of a hollow viscus *(12)*. We saw only one patient with a ruptured viscus. He did not adopt a 'crash posture' but remained upright in his seat. It may be that correct positioning of the lap-type seat belts prevented more serious intra-abdominal injuries occurring in survivors of the M1 air crash.

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